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THE TRANSCONTINENTAL LINES OF THE WEST

By A. E. PERKINS
State Normal College, Ypsilanti, Mich.

OF the six great transcontinental lines of railroads of the West completed at the present time the Great Northern has, when considering distance and total amount of lift, by far the best route. Fig. 1 shows that it has the most nearly direct route and that it crosses the Rockies at their narrowest and lowest point.

The 100th meridian has been selected as the eastern boundary of the West United States, for it is at about this meridian that the elevation, rainfall, products, density of population, development of railroads, etc., show the greatest differences east and west.

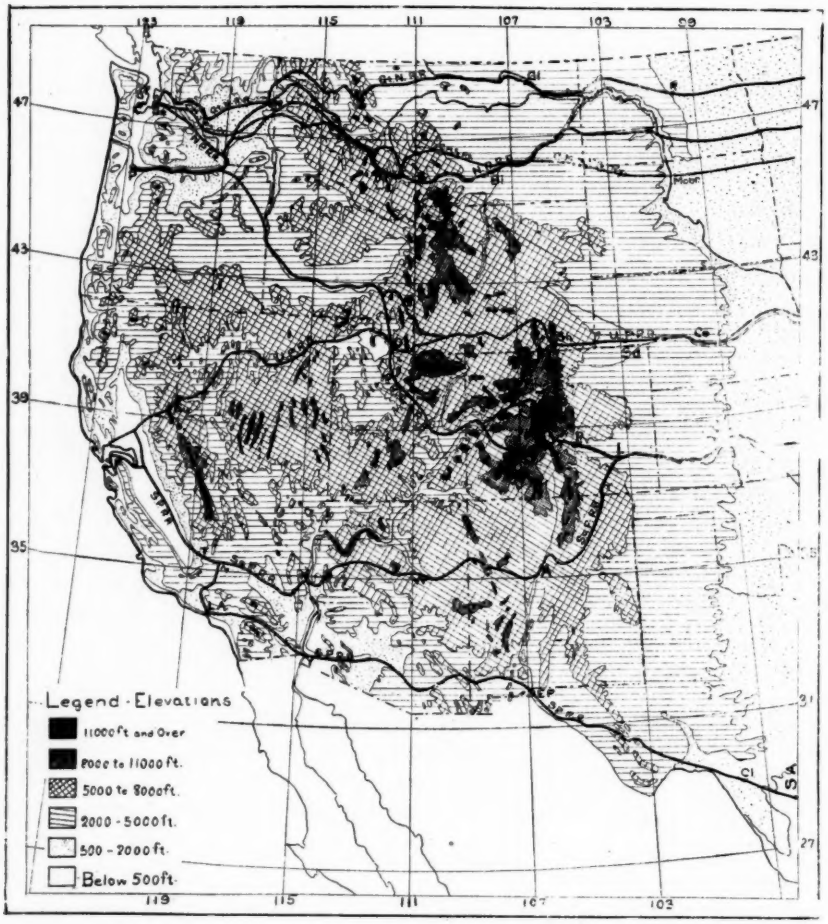
The Surveys sent out by the Government in 1853 reported in 1855 that there were several feasible routes across the West. But nothing definite was done until 1862, when a bill making the appropriations and land grants passed Congress. Between 1862 and 1875 many other grants were made only a few of which ever resulted in the building of roads. Even on roads that were begun the work moved slowly.

The Union Pacific, which began work in 1863 from both Sacramento and Kansas City and met at Promontory Point near Ogden in 1869, was an exception.

A grant for the Northern Pacific, called the 47th parallel route, in 1864, had by 1874 only four hundred and twenty-four miles completed on the east and sixty-five on the west. The road was finished in 1883, nineteen years after the date of the grant.

The Santa Fé, one of the early grants, had by 1879 only twenty-five miles graded and was not completed until 1883, just two months before the Northern Pacific.

Even the building of the Great Northern shows that railroad building was a slow process up to within the last fifteen or twenty years at least. This road began construction in 1879 and it was not until 1893 that it was completed to its western terminus. The Great Northern is conspicuous, however, in being the only one of the transcontinental lines that started and completed its route without the help of a dollar or the grant of a single acre of land from the United States Government.



But why the transcontinental lines? There were several reasons:

At first it is probable that all were animated with the spirit of American expansion. Hordes of settlers had been pouring through the passes

of the Appalachians since near the beginning of the nineteenth century, and had by 1830 settled as far west as the western border of Missouri and Arkansas. Even at this point they began to feel that they were becoming isolated from the Atlantic seaboard. It is a significant thing that most of the first appeals for railroads to the west were made by far sighted men of the then West. A railroad was something new. By 1835 we had but one thousand and ninety-eight miles in the whole country and they were still in the experimental stage in the East. But to persons acquainted with the slow rate of travel by dirt road they were looked upon as the only means of communication with the East if this expansion was to go on.

On the west coast we had a growing population separated from the East by fifteen hundred miles of deserts, plateaus, and lofty mountain ranges. Oregon's population in 1850 of thirteen thousand three hundred had by 1830 grown to fifty-two thousand five hundred; California from 1850 to 1860 had increased from ninety-two thousand six hundred people to three hundred and eighty thousand; and Washington by 1860 had a population of eleven thousand six hundred. These half million people required some means to keep them in touch with the East. There were grave fears that the West Coast might set up a separate government. This must be avoided by all means. If they were to remain a part of the nation a railroad was the only means of keeping them in sympathy with the other parts of the country and was necessary to protect them from invasion by furnishing the only means of rapid transportation of troops and munitions of war.

Visions of the United States as a great commercial power on the Pacific no doubt incited some. A railroad would help to draw the trade of the Orient and enable the eastern United States to better compete with the other world powers.

The discovery of gold in 1849 in California and the great loss of life and time on the overland routes to the El Dorados of the West showed the need. In 1860 and 1861 valuable metals were discovered in Colorado and Nevada. These discoveries increased the population greatly. Colorado soon had a population of over thirty-four thousand and Nevada of seven thousand.

The Mormon Rebellion of 1857 showed that a hostile force within the border in the midst of these growing centers on the plateaus needed some consideration.

The conditions under which these lines were to be constructed were

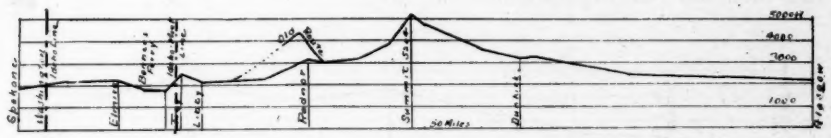
the most trying of any that railroads up to that date had had to overcome. From the Mississippi River to the crest of the Cascades and Sierra Nevadas the country was for seven-eighths of the way a vast desert, unsettled except in a few places, infested by savages so stubborn that the construction parties were under constant surveillance of soldiers and each gang was a body of minute men ready to stack pick or shovel for use of gun at any moment. There were no large cities, nor rich agricultural lands to feed the new arteries of commerce. The Pacific Coast was the goal. It alone was to be the fountain head for east-bound traffic.

In the construction of the railroads of the East there were populous cities, rich farming communities and towns and villages without number that were the feeders for any line. From the very start these roads were found to be a paying venture. But in the West the settlements followed the railroads. Much of the territory passed had been previously visited only by scouting parties, troopers or mine prospectors. In one way this had its advantage. Route could be guided by topography alone. The engineers would be free from the bickering and bantering of petty politicians and even Congress in their endeavor to direct the course of the road whether natural conditions were suitable or not.

Then, too, the passage of the Rockies, Wahsatch and Coast Ranges was no mean undertaking, requiring the construction of tunnels, the bridging of canyons and the filling of ravines. In the building of these roads was developed the American method of railroad construction. The object was to get the road to the terminus along the line of least resistance irrespective of curves, bridges, or distance so that earnings would begin as soon as possible. When earnings stood, its grades were reduced, culverts and bridges replaced by more substantial ones, and curves lessened.

The Transcontinental Railroads were but following the general tendency of trade routes to extend east and west. They followed for part of their way the great trails: the Union, the Overland or Mormon trail; the Northern Pacific, the Lewis and Clark; the Santa Fé, the Santa Fé trail. The courses of these trails were determined largely by the course of the rivers. Running through a region of considerable aridity, these streams offered an unfailing supply of water. The Platte, Arkansas, Yellowstone, and Missouri Rivers led the routes to the crests of the Rockies. Thence by way of passes largely influenced by these and west flowing rivers they crossed this barrier and were led into the head waters of great west-flowing streams. How advantage was taken of the easy grade of the river valleys, and how the routes were laid to take advantage

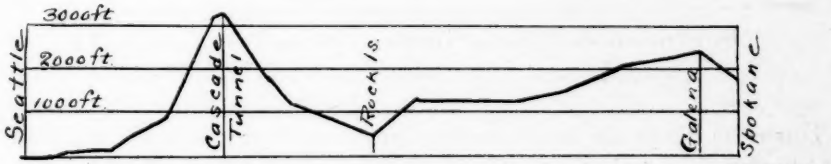
of these and scout the higher lands will be brought out in the brief description of the several routes.



Great Northern – Glasgow to Spokane. – Fig. 1a.

Vertical 100 x Horizontal

The Great Northern (Great Northern Railroad in Fig. 1) from Rugby, N. D. (R) to eastern Montana makes no use of river valleys. It soon drops into the valley of the Missouri-Milk Rivers and follows them up until at about Ft. Assiniboine. Here it leaves the valley and approaches the summit (S) by a gradual grade, as shown by the profile (Fig. 1a), which it crosses at an elevation of five thousand two hundred and four feet. From here to Rock Island on the Columbia there is a gradual descent until six hundred and seventeen feet above sea level is reached (see profile). Then begins a rapid ascent to cross the Cascade Ridges, which it does by means of the Cascade Tunnel at an elevation of three thousand three hundred and seventy-five feet. From here to Seattle there is a rapid descent to seven feet above mean sea level. The old route shown on the profile near Radnor was a shorter one than the

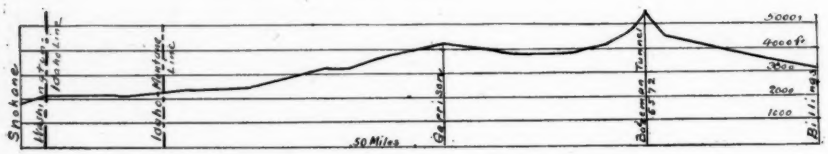


Great Northern – Spokane to Seattle – Fig. 1b.

one now in use. A lower pass to the north was found and now from near Columbia Falls the route lies in a northwest direction until an upper branch of the Kootenai River is reached, thence the route lies along in this river valley until the old route is again picked up. The profile shows that this new route, though longer, saves a climb of over one thousand feet.

The total distance traversed from the one hundredth meridian (R) to Seattle is one thousand three hundred and sixty-two miles. The total lift for west-bound trains is seven thousand and fifty-one feet and for east-

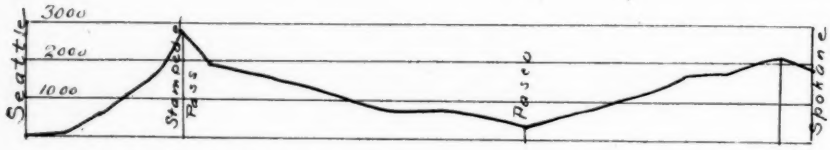
bound eight thousand five hundred and eighty-eight feet—the difference being the altitude of Rugby. The highest point reached is that at Summit, five thousand two hundred and four feet.



Northern Pacific - Billings to Spokane - Fig. 2a.
Vertical 100 x Horizontal

The Northern Pacific (N. P. R. R. in Fig. 1) makes use of the valley of the Yellowstone to approach the highlands. Near Livingstone it leaves the Yellowstone, crosses over the divide between the Yellowstone and Missouri by means of the Bozeman Tunnel (B. Fig. 1) at an elevation of five thousand five hundred and seventy-two feet. (See Profile Fig. 2.)

Threading its way along the valleys of West Montana, it soon passes into the valley of one of the branches of the Columbia. From Bozeman



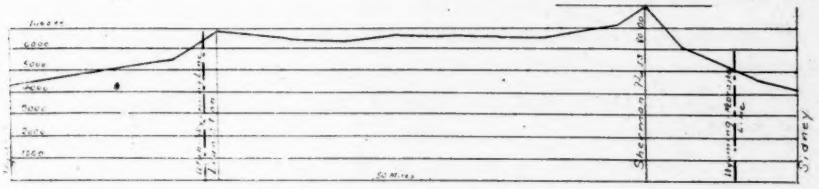
Northern Pacific - Spokane to Seattle - Fig 2b.
Vertical 100 x Horizontal

Tunnel to Pasco the route is down grade until at the latter place the Columbia is crossed at an altitude of three hundred and eighty-nine feet. From here the route is like that of the Great Northern up grade, but the grade is not quite so great. The Cascades are crossed by means of the Stampede Tunnel at an elevation of two thousand eight hundred and thirty-two feet—over five hundred feet lower than the pass of the Great Northern.

The total distance from the one hundredth meridian to Seattle is one thousand five hundred and ten miles. The total lift for west-bound traffic is seven thousand and eighty feet and for east-bound eight thousand nine hundred and sixty feet.

The routes of the Great Northern and Northern Pacific are very

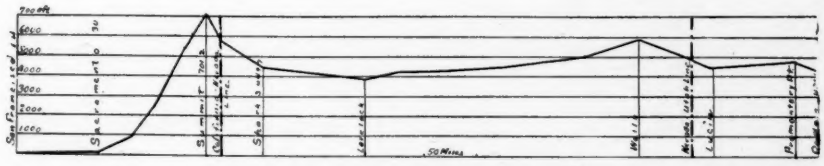
similar, but in both distance and lift the Great Northern has the slight advantage. Both lie in a region supplied with an annual rainfall of ten to twenty inches and in some parts even as high as thirty inches. The Southern Pacific and Santa Fé Railroads, lying in regions of great aridity, are not so well located as these. The railroads in the north pass through regions of more extensive forests and where grazing and some forms of agriculture are possible, and thus have a richer region to draw freight from.



Union Pacific - Sidney to Ogden - Fig 3a.
Vertical 100: Horizontal

The Union Pacific (U. P. R. R. in Fig. 1) may properly be called the plateau route, since having once reached the highlands it continues at a great elevation until the west border is reached. (See Profile.)

From the one hundredth meridian (Co. Fig. 1) to Sherman Pass there is a gradual rise. The Laramie Mountains are crossed at this place



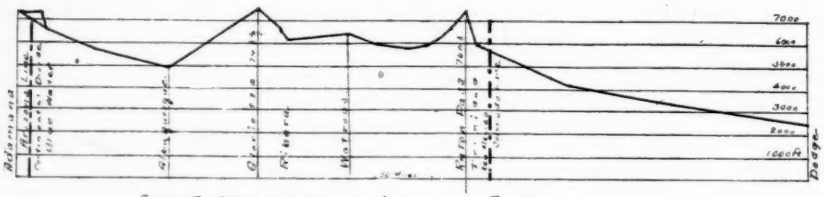
Union Pacific - Ogden to San Francisco. - Fig 3b.
Vertical 100: Horizontal

(Sh. Fig. 1) at an elevation of eight thousand feet. In the next eighty-three miles there is a drop to the six thousand five hundred foot level, and keeping between this height and six thousand two hundred feet the route crosses nearly the whole of Wyoming. As it nears Ogden there is a gradual drop to four thousand three hundred feet, but from here to Summit (see Su. Fig. 1), the crossing of the Sierra Nevadas, the course lies mainly in the valley of the Humboldt River and lies mostly between

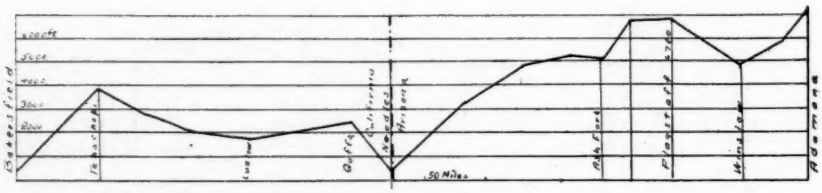
four thousand three hundred and five thousand feet. After passing the Sierra Nevada Mountains at Summit at an elevation of seven thousand and twelve feet it descends by steep grades to the Pacific terminus, fourteen feet above sea level.

The total distance from the one hundredth meridian to San Francisco is one thousand five hundred and forty-one miles, the total lift for westbound freight is ten thousand nine hundred and seventy-eight feet, for eastbound thirteen thousand four hundred and sixty feet.

The Santa Fé (Sa. F. R.R. in Fig. 1) from Dodge, Kansas, westward, approaches the highlands by the Arkansas. Near La Junta it leaves the river and keeping to the east of the mountains its course lies in a S-SW direction to Trinidad in Southern Colorado. Near here it surmounts a ridge, the Raton Hills, by Raton Pass at seven thousand six hundred and eight feet altitude.



Santa Fe R.R. - Dodge City to Adamana. - Fig 4a



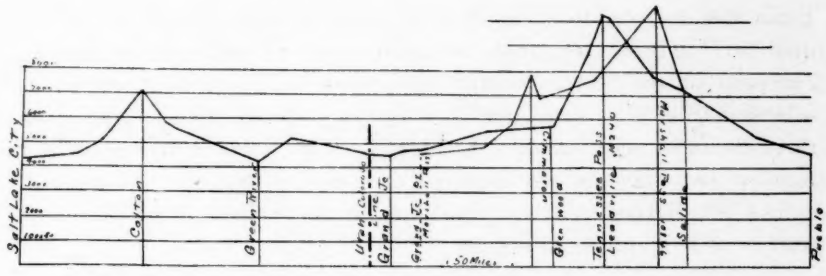
Santa Fe R.R. - Adamana to Bakersfield - Fig 4b

The drop at Albuquerque, N. M., is made by passing down the Rio Grande River valley to this place. The rise at Raton Pass could easily have been avoided by passing about fifty miles to the east of the Raton Hills (see Fig. 1) but it is understood that certain settlements in Southern Colorado influenced the builders in having the route as it is. The other depression at Winslow is in the valley of the Little Colorado.

From Ash Fork there is an ever-increasing descent to the Colorado River which it crosses at Needles about four hundred and eighty feet above the sea level. Before reaching San Francisco it must again reach an elevation of nearly four thousand feet at Tehachapi.

The distance from Dodge, near the one hundredth meridian, to San Francisco is one thousand seven hundred and forty-nine miles, the total lift west-bound fifteen thousand and sixty-six feet, east-bound seventeen thousand five hundred and forty-six feet—the greatest lift by over four thousand feet.

The Denver and Rio Grande (D. R. G. R. R. in Fig. 1) has been brought in merely for comparisons. From Pueblo westward its course lies along the Arkansas River through the Royal Gorge, here requiring some of the greatest feats of engineering. At Salida there are two branches, one to the north by way of the Tennessee Pass crossing the divide between the Arkansas and Grand at an elevation of ten thousand two hundred and forty feet, 2,240 feet higher than the greatest height reached by any of the great transcontinental lines. The Marshall Pass route offers a

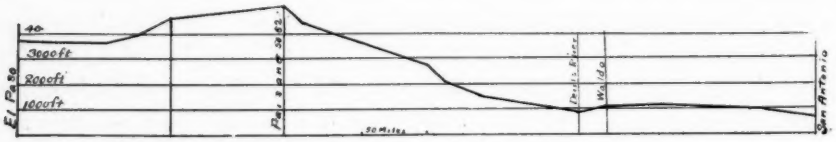


Denver and Rio Grande - Pueblo to Salt Lake City - Fig 5.
Vertical 100: Horizontal

greater height, ten thousand eight hundred and forty-six feet. These two branches join at Grand Junction. Before reaching Ogden another elevation of over seven thousand feet must be passed at Colton. The Rio Grande has been termed the "octopus." Certain it is that tunnels, grades, fills or bridges without number seem not to deter it from extending its arms out into every nook and corner of Colorado where the products of the mines are to be found. Between Salida and the summit at Marshall Pass the railroad rises three thousand eight hundred and six feet in twenty-five miles or a grade of one hundred and fifty-two feet per mile,

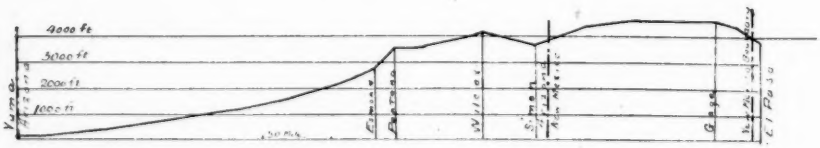
nearly four and one-half per cent. At one place on the Marshall Pass route the grade reaches two hundred and eleven feet per mile.

The Southern Pacific (S. P. R. R. in Fig. 1) rises to the Highlands by easy grades reaching the east edge and summit at Paisano (five thousand and eighty-two feet altitude). From here to Pantano the route is on a plateau on the average of four thousand feet in altitude. From Pantano westward the course is down grade to the Colorado River, which it crosses at Yuma at an altitude of only one hundred and forty feet. In Southern California the route lies for about forty miles below sea level. At the station of Salton it is two hundred and sixty feet below sea level.



Southern Pacific R.R. San Antonio to El Paso - Fig 6.a.
Vertical 100x Horizontal Scale

From Los Angeles to Bakersfield a height of three thousand nine hundred and sixty-six feet must be surmounted in crossing the westward extension of the Sierra Nevada Mountains. This barrier offered considerable trouble in surmounting, "requiring eleven tunnels and a spiral three thousand eight hundred feet long." The grade in one piece of the route is two thousand six hundred and seventy-four feet in twenty-five miles. At Bakersfield the railroad is in the valley of California and reaches its terminus by easy grade.

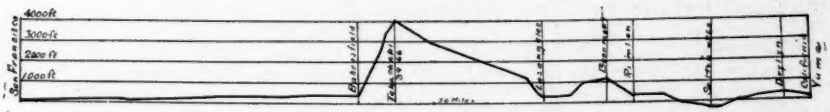


Southern Pacific RR El Paso to Yuma - Fig 6 b
Vertical 100x Horizontal Scale

The distance to San Francisco on the Southern Pacific is one thousand seven hundred and ninety-eight miles, the total lift west-bound ten thousand seven hundred and fifty-nine feet, east-bound eleven thousand seven hundred and fifty-six feet. The route lies in a region of great aridity,

the rainfall being below twenty inches in the east and for about one-third of the way much below ten inches. Mines are few. Most of the traffic is through freight.

The completion this year of the Chicago, Milwaukee and Puget Sound Railroad, an extension of the Chicago, Milwaukee & St. Paul, enables the Harriman interests to compete with Hill for the traffic of Puget Sound, perhaps the greatest gateway on the Pacific Coast, for it

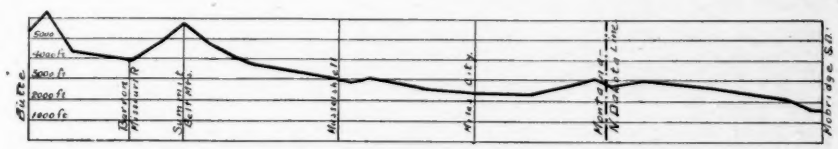


Southern Pacific R R Yuma to San Francisco - Fig 6c.

Vertical 1000 Horizontal. Scale.

offers the shortest route to the Orient, through it must pass the products of Alaska, a land whose possibilities are just beginning to be discovered and back of it are the forests and rich agricultural lands of Washington and Oregon.

The profiles* for this railway are similar to those for the Northern Pacific and Great Northern. It offers a shorter route than the Northern Pacific but to do so must cross two elevations in central Montana and two in the Cascade region, thus increasing its lift to considerable more than that of the Northern Pacific Railroad.



Chicago, Milwaukee & Puget Sound Ry. - Mobridge to Butte - Fig 7a

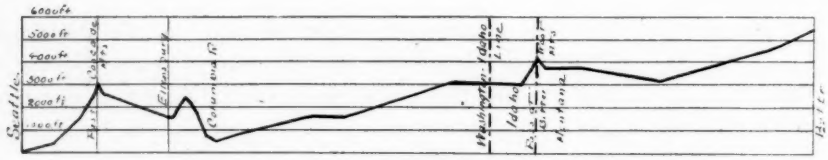
Vertical 1000. Horizontal Scale.

From Selby, near the one hundredth meridian, westward the route is comparatively level. It follows the Missouri for some of the distance, but near Malaga leaves it and crosses over to the Musselshell, reaching this stream near the town of Musselshell. From here the route is up-grade (see profile), a very even up-grade, along the Musselshell River.

*Through the courtesy of Mr. D. J. Whittemore, Chief Engineer of lines east of Butte, and Mr. E. J. Pearson, Chief Engineer of lines west of Butte, it is possible to present the profiles of the Chicago, Milwaukee & St. Paul Railroad with the other transcontinental lines of the west.

This river leads to the ridge of the Belt Mountains, the divide between the Missouri and Smith River, a branch of the Missouri. After crossing this divide at an elevation of five thousand seven hundred and eighty-four feet, the route descends into the valley of the upper Missouri. Butte lies near the head waters of one of the branches of the Missoula, a west-flowing stream. To get to Butte therefore another ridge, the Continental Divide, must be crossed at an altitude of six thousand three hundred and fifty-two feet, the highest point reached by this road and about eight hundred feet higher than that reached by the Northern Pacific. The Northern Pacific reaches the upper Missouri about at the same point, but in its course westward it avoids the ridge east of Butte by going north through Helena and leaving Butte off its main line.

From Butte westward the route is down-grade down the valley of the Missoula. At St. Regis it leaves the valley and shortens the route to the west by making a slight but steep grade to cross the Bitter Root Mountains on the boundary line between Idaho and Montana, and drops into the valley of the St. Joe River. From here to the Columbia the route is



Chicago, Milwaukee & Puget Sound Ry-Butte to Seattle-Fig 7b

Vertical 1000 Horizontal Scale

down-grade. After crossing the Columbia about forty miles westward it reaches Ellensburg, a city also on the Northern Pacific. The latter railway, however, to get to Ellensburg from the Columbia passes up the Yakima River, but the Chicago, Milwaukee and Puget Sound cuts boldly across the ridge east of Ellensburg, shortens the distance, but adds a grade of about a thousand feet.

The passage of the Cascade Mountains is at an altitude of three thousand and ten feet, about the same as the Northern Pacific and Great Northern.

The total distance from the one hundredth meridian to Seattle is one thousand three hundred and ninety miles, the lift west-bound eleven thousand two hundred and two feet, that east-bound twelve thousand eight hundred and sixty-one feet. The essential figures for comparison of lift and distance are arranged in Table I.

TABLE I

RAILROAD	DISTANCE FROM 100TH MERIDIAN	LIFT WEST-BOUND	LIFT EAST-BOUND
Great Northern	1,362 miles	7,021 feet	8,588 feet
Northern Pacific	1,510 "	7,082 "	8,962 "
Union Pacific	1,541 "	10,978 "	13,460 "
Santa Fé	1,749 "	15,066 "	17,546 "
Southern Pacific	1,798 "	10,759 "	11,756 "
Chicago, Milwaukee and Puget Sound	1,390 "	11,202 "	12,861 "

The Santa Fé has more than twice the grade of the Great Northern or Northern Pacific and about half again as much as the Union Pacific. The Southern Pacific has over four hundred miles farther to go to reach its terminus than the Great Northern and about three hundred miles farther than the Northern Pacific. The artificial harbor at Los Angeles when completed will shorten this distance by about five hundred miles and save a lift of nearly four thousand feet.

This difference of grade and distance must have some effect upon the success of the road, but there are so many other elements that enter into the question that no predictions could be made safely. It lies mostly with management. In this the most important perhaps is the development of feeders. In this one item especially the Hill lines are best supplied.

If we consider Chicago as the focal point for transcontinental freight the two southern and the three northern routes are at a great disadvantage when compared to the Union Pacific because of distance. The Union Pacific is the central route and has the advantage of other ways besides distance. It extends through and between the only great chain of cities that extend across the continent west of the Lakes' region and draws freight from Chicago, Omaha, St. Louis, Kansas City, Denver, Salt Lake City and San Francisco. It leads westward from that region in the Central Valley where is located the center of population of the United States, the center of farms, the center of manufacturing, and offers the shortest distance from here to one of the only two great harbors on the Pacific Coast. But with the growth of the Puget Sound region as a shipping point and low grade offered by the northern routes the result can not be predicted.

SECONDARY SCHOOL GEOGRAPHY IN THE MIDDLE WEST

By W. M. GREGORY
Normal School, Cleveland, Ohio.

IN the last ten years there have been many changes in the various secondary school sciences. Those which have been rejuvenated by new movements are living, although not gaining in numbers, while those lacking the influence of strong champions have been about eliminated from the schools of this region. Geology and astronomy have practically no place at all, while biology or natural history has suffered from the extreme study of types and dissection which has prevailed under university influence. There is at the present hour a desperate effort being made to save the latter study by injections of civic biology or to let a first-year mongrel science course replace it. In botany and zoölogy there is dissatisfaction and the courses are arousing less interest and enrolling fewer pupils than ten years ago. The three sciences which lead in the secondary school are physics, chemistry and physical geography or physiography. In the past ten years chemistry and physics have undergone many fundamental changes, while the earth science is in the throes of a radical and much needed readjustment. The demands for a change in the latter subject are taking definite form, as may be seen by the current magazine criticism of the present course, in the appointment of the various revision committees, especially those of the National Educational Association and the American Association of Geographers.

In Cleveland the enrollment in physical geography in 1900 was over 525 and in 1909 it is 292, and in this same period there has been a marked increase in the high school population. The reasons for the decrease are ascribed to different causes; other easier and more attractive electives, poor teaching, no vital connection with life, too highly specialized for the students, too many failures, and not at all suited to the needs and the understanding of the pupils. During the past eight years there has been a steady decrease in the total number of pupils enrolled in the secondary school geography. This loss has been marked in Ohio, Pennsylvania and Illinois, which are the states leading in the enrollment in this subject in the country. This marked loss in a subject which has a greater enrollment than any other science, has been of much concern to those believing a

modern high school should devote a large part of its time to the sciences. If the decrease continues for ten years longer this subject will be eliminated.

The general unsatisfactory results in the present secondary geography, led the writer to an inquiry concerning its condition in the middle west, and more than a hundred replies have been received to a questionnaire sent to the larger secondary schools. The conclusions of this paper are drawn from the data furnished by those actually teaching in these schools. It does not seem to matter what the courses are in secondary school geography, whether physical geography, physiography, earth study, commercial geography or geography of commerce and industry, they are unsatisfactory to the majority of teachers and are declared by them as being unsuited to the immediate needs of the larger number of pupils in this region. In some of the few schools where physical geography is considered satisfactory by the instructor there is often an obvious reason for this attitude. It may be a pet laboratory scheme, special pieces of apparatus, a particular notebook or textbook, at any rate there are some oblivious to the actual needs of the students as seen by the greater number of teachers.

With those who feel that the present results warrant changes, there are three factors, the pupil, the teacher, and the subject matter, each of which must receive a careful consideration by experienced teachers.

In this course the needs of the pupil must have first consideration and the whims of a teacher or oddities of a text must be secondary. As to who shall determine what is most desirable for the student, there has been much discussion. Shall it be determined by college requirements or shall it be shaped by the pursuits and occupations that 85 per cent. of the high school graduates enter? There is an overwhelming answer to this question from more than a hundred schools of the middle west, that the college requirements shall not determine the high school course.

This is the situation, that while the college influence towards highly specialized physical geography is not approved, nevertheless the majority of the courses are dominated entirely by that influence and the text-books are used in the first year of the secondary school geography that were written for college work and from the university view point.

So strong has this influence been towards systematic physiography that if it were suggested that secondary school geography be more related to the life of the student through the industries, occupations and local geography of their community, such changes have been curtly dismissed with the comment, that they were not physical geography, but still this criticism is met by the texts on physiography by clinging to the principles of dynamic

geology in the fore chapters and attaching at the end miscellaneous chapters on life relations and ecology.

The average pupil in secondary geography comes to this subject in the first year with no conception of scientific thinking, and immediately in the average course, he is confronted by the confusion of the contour map, the fundamentals of dynamic geology and while it is deplored, yet the genetic development of land forms is presented in various disguises. The extensive study of dynamic geology is placed first in such a course to accommodate the field work of the high school, but this explanation for its position does not stand a fair investigation, as only one school out of 25 actually make the field trips.

The discussions of physical geology are accompanied by laboratory exercises, in which the devices and schemes frequently befog both the good things in the geology and the interest of the young student. The laboratory work on the contour map has been pushed to the extreme limit. In some classes the geographic factors are overlooked and the contours are discussed, measured, drawn and drilled upon. Here is a laboratory manual full of contour exercises and in each of which there is only the merest mention of the life relations. Here is a class that has studied the contour maps in forty different exercises and on actual quizzing could locate but four of the map sheets studied, could not give the large physical features of the United States and had no conception of the geographic factors which governed the location of their own city. They could measure the distance between the contours, select the river and count the branches, tell a plain from a plateau, name the town on a particular map through which a certain contour passed, give the highest and lowest point on each map studied and plenty of other similar mechanical matter, but no serious criticism arises as to the value of this orthodox work to the student.

Consider some of the ideas advocated for use in the secondary schools. Construction of a model of Mt. Shasta by mounting the cut-up contour map, problems in map projection which belong to the cartographer, tracing of the contours of a map sheet on thin paper, the construction of maps on elaborate nets, the study of several sheets to show the development of cirques, the seeking of mental development in mud-puddle problems, and the extensive study of twelve different kinds of plains from the map sheets and no mention of their human relations.

The laboratory equipment for physical geography in one school of the middle west is valued at three thousand dollars, it is rich in geological maps, models of the Grand Canyon, topographic maps, mineral specimens,

and mud-puddle tanks. The purely dynamic side has been emphasized to such an extent, the real geographic features and the connecting facts are lost, while the pupils are put to explaining and theorizing on the facts of a phenomenon with which they are not acquainted. The subject has been exterminated in this particular school. The principles of physical geography can not be best taught to the secondary student in an abstract manner, but there must be supplied an abundance of concrete illustrations.

It appears from the writer's experience a doubtful procedure to begin the study of the dynamic processes involved in the development of land forms before a simple presentation of the elements of climate. It seems a serious mistake to attempt the more complex problem, when the study of the weather allows the use of much material easy of access and particularly well fitted to introduce the young student to scientific methods. The relations between cause and effect in life relations are very striking in the weather and climate of the student's home and with clear definite conceptions he is better prepared to approach the study of the land as acted upon by the climatic forces. The importance of the elements of climate in their influence upon life and the occupations of man are to be given more attention, rather than this time devoted to the physical or chemical experiments to determine the air pressure, latent heat, constituents of the air or the theoretical circulation of the atmosphere.

In the land study there must be considerable stress given to the soil and its formation, its distribution in North America and its relation to vegetation and the occupations of man. This is a vital part of geographic study which is quite generally neglected in our present courses. The rivers, lakes, plains and the mountains are the great geographic forms to be considered not in a genetic sense nor from the standpoint of dynamic geology but from the effect they exert upon activities, industries and life. Mental discipline in the inductive and deductive reasoning can be abundantly secured from those conditions which concern human interests and such discipline will be fully as vigorous and beneficial as that now obtained from systematic classification of land forms or the various problems of dynamic geology. If some critic says this is not geography, he thinks only of physical geography, which it is granted this is not, but this life element should constitute a larger part of the secondary school geography.

The pupil needs as a part of his geographical learning a definite idea of the resources of his country. He should have an idea of their value, distribution and relation to the various occupations. He must be shown that the life of a nation is due directly to its resources and hence those

industries which occupy the attention of the great mass of the people must be studied in the light of their geographic factors. It is a weakness in the present secondary school geography that so little of it really touches human life and so much time is given to the discussion of the pure physiographic processes. The criticism has been made by the advocates of the present course that the industrial and political studies are not geographic; this objection applies with equal force to some parts of the physical geography which are only absorptions from the other sciences. Still, this criticism is not a just one from either side, for a course in geography will necessarily touch many of the other sciences. The point of difference is the kind of material that should constitute such a course and this must not be selected entirely from one viewpoint. There is no reason in choosing this material because it is logical from the scientific standpoint when it is not what the pupil requires as a useful citizen. When the pupil has completed his secondary school geography, he should possess definite ideas concerning the geographic features of his home region and how they have influenced its industries, commerce and activities. He should have a clear idea of climate and climatic control of life. The great features of his own country should have his acquaintance not alone from a mere physical standpoint but the industrial and political aspects as well. Some old-fashioned place geography, not on traps of map nets, but straight map study, should be woven into his geographic fabric.

The teacher is an element to be considered when the status of a course is under discussion. It is acknowledged that the instructors in secondary geography are poorly prepared and are ready to faithfully follow the lead of any text. In many schools the physical geography is given to teachers irrespective of their training and the results are not hard to predict. Out of a hundred teachers selected from the schools of the middle west, only 50 per cent. of them ever had a college course in geography and only 5 per cent. were specially trained for their work. Teachers thus limited will not cast a poor text aside but are sure to lean heavily upon it and its ideas. The text is the most potent influence in shaping the nature and content of the course in secondary school geography.

Much criticism comes to the present course in physical geography from those competent to judge from their experience in teaching and from the university men who shape the course in the text-book. The high school product in geography is justly ridiculed by business men because the most common ideas of places, products and resources of our country are unknown to the pupils, while plenty of theories of earth origin, glaciers,

volcanoes and earthquakes are massed in a lump of vague generalities. The university men point out the deficiencies of their freshmen in the elementary knowledge of the direction, scale and use of the most common maps. Their freshmen are shown by a series of simple tests to have but little knowledge of some things fundamental in geography, as the location of important cities, rivers and states of their own country. The extreme stage of specialization has been reached in physical geography, it has succeeded in excluding much information from a course in geography which is necessary, useful and disciplinary to all classes of students. Physical geography in the secondary school has had its influence upon the elementary geography of the grades, where hazy abstract ideas have in some cases crowded out the map study, home geography, study of life and the occupations.

There is too much theorizing and systematizing with facts which are not known or understood by the secondary students. Some courses are largely elementary physics and structural geology in which most of the laboratory experiments, that do not deal with the contour maps, consist of physical experiments. Our text writers, knowing the weakness of the students using their books, are slow in giving us a remedy. They have, it is true, changed in the last few years the order of teaching the land and the climate; this was only a shift of material with no fundamental changes in the text matter. Chapters have been summarized and much effort has been expended in writing the subject matter in simple terms. The simplified course has many statements that are misleading and are not worthy of a secondary text. The effort to enrich the course by a profusion of pictures has given us picture primers that appeal to the student only superficially and is a practice which needs considerable curbing in the number and character of views selected. The maps are largely reproductions of map sheets and few of the texts supply maps or any aids whatever for the study of those things that their authors find so deplorably lacking in their freshman students. There have been some attempts to remedy this ignorance of maps by practice in the construction of maps on nets of longitude and latitude, but this seems misplaced energy—it is not map construction that is wanted, it is map knowledge. We need more rigorous text matter with fewer pictures; none of the subject matter should be digested in summaries, an entire elimination of physical and chemical experiments and a reduction in the study of contour maps. The teacher is criticized for attempting to depart from the text, but even the inexperienced instructor who is observing the results, feels that the present texts, excellent as

systematic physiographies or compends of dynamic geology, do not really meet the requirements of the pupils.

The present average course in physical geography in the middle west should be replaced by a first-year course in geography which deals less with the physiographic theories and more with the fundamental concepts which control life and human interests. This course, for which there is an earnest demand, will include the elements of commercial, physical and political geography carefully systematized for the needs of the pupils. A share of its fundamental concepts will be obtained from a study of the home conditions, and from these ideas it is possible to undertake a regional study of North America which will be especially directed to the United States and will necessitate abundant work with the materials of geography. It seems apparent that much can be accomplished by text writers if their efforts are concentrated upon the problems of the first year and an attempt made to remedy the present over-specialization which if it is allowed to continue will eliminate geography from the secondary school course.

TRANSANDINE RAILWAY TUNNEL.—The work on the great Transandine Railway tunnel is rapidly progressing. In August last 1,325 meters had been drilled from the Chilean side of the crest of the Andes Range and 1,050 meters from the Argentine side, or a total of 2,375 meters. The tunnel, which is situated at an altitude of 3,200 meters, will be 3,030 meters long. The junctions of the headings will probably be effected by the end of March, 1910. The completion of this tunnel will give through railway communication between Valparaiso and Buenos Aires.

—From *Bulletin of American Republics,* September, 1909.

CEMENT FOR PANAMA CANAL.—A million tons of cement will be used in the construction of the Panama Canal, about 20,000 tons of which will be shipped monthly from the United States, the transportation covering a period of approximately four years.

—From *Bulletin of American Republics,* October, 1909.

ECONOMIC NOTES

By EDWARD VAN DYKE ROBINSON

The Grand Trunk Pacific Railway has been constructed through much of the prairie section. At Fort William a terminal elevator having a total capacity of about 10,000,000 bushels of wheat, is under construction and rapidly nearing completion. The cost of the prairie section has been about $35,000 per mile. It is claimed that this route will save approximately 500 miles to Yokohama, as against the present shortest route from England. The town sites in Prince Rupert, the terminal of the Railway, have already been placed on the market; and about 80 new town sites have been opened on the prairie section between Winnipeg and Edmonton.

Another Canadian Railway which has been under discussion for a long time is the Hudson Bay. The preliminary survey of this route has been completed and an engineering party is now in the field making a final survey of the route. The preliminary report was of such a nature as to leave no doubt that the Hudson Bay terminus will be York, rather than Fort Churchill.

An experiment has been undertaken by the Canadian Government to determine the practicability of reaching the Pacific Coast by water. Shipments have been arranged from Montreal down the St. Lawrence River, by sea to Port Mexico, thence by rail over the Isthmus of Tehuantepec to Salina Cruz, and thence again by sea to destination. By this route the goods will go in bond through Mexico. It is believed that in spite of the greater distance, goods can be carried to ports in British Columbia cheaper than by rail.

Since the Government Merger of Railways in Mexico, the construction of new lines has proceeded apace. The Southern Pacific Railway, building south from Guaymas, has already reached and passed Mazatlan, thus forming a trunk line along the Pacific Coast. The same line is to be continued inland, and on to the plateau. It is expected that Guadalajara will be reached in 1912.

In Uruguay a contract has been signed between the Government of Uruguay and the Pan-American Trans-Continental Railway Company for the construction of a line from the north border of Uruguay to the south border at Colonia, a distance of 373 miles. This will leave only

about 25 miles to be completed in South Brazil in order to connect the Brazilian roads with those of Argentina.

The extension of the Paraguay Central Railway from Pirapo to Encarnacion on the Paraná River seems finally to have been undertaken in earnest. This is the section which so many of the books have been reporting for so many years as already completed. The Argentina Northeast Railway is also building towards Posadas on the Argentina side of the Paraná. When completed, which it is hoped will be within three years, these extensions will connect the railway systems of Paraguay and Argentina. In this connection it may be noted that the tunnel through the Andes, under the Uspallata Pass, will be completed, according to recent reports, by next June.

In Chile the expected has finally happened. A new steel plant costing about $2,000,000 U. S. gold and with a daily capacity of about 200 tons, is under construction at Corral. It will probably begin operations early in 1910. Excellent iron ore is found within 5 miles of the plant, to which it will be carried by an overhead cable worked by gravity. Coal is also found in the immediate vicinity. This is the first modern steel plant in America south of Monterey, Mexico.

The railway from Peking to Kalgan has finally been completed. This route goes through the famous Nankou Pass, an extremely deep canyon so narrow that for generations it has been barred by huge gates built on the plan of city gates. The road has been built by the Chinese Government, and will doubtless be continued to Urga, the capital of Chinese Mongolia. This is the route over which the Russians planned to build a railway, before the war with Japan. It follows the ancient caravan road through Mongolia and South Siberia to Europe. With the building of this road the appearance of the long trains of camels in the streets of Peking is probably a thing of the past.

In Korea the Japanese Protectorate authorities have not only completed the main trunk line from Fusan to New Wiju, but have also undertaken and in part completed branch lines to Seoul, Masampo (the new Japanese Naval Station), Chinampo and Gensan.

The port of Fishguard, located near Swansea, is now in use both for transportation across the Irish Sea to Ireland and for Trans-Atlantic traffic. Passengers are enabled by this means to save the entire time taken by the vessels in rounding the promontory of Wales and reaching Liverpool. Those travelling by the Lusitania or Mauritania can eat breakfast in New York on Wednesday and on the following Monday, in London. This

illustrates the tendency of passenger and mail traffic to seek out-lying ports.

The deepening of the Canal to Ghent has now proceeded so far that all except the largest class of ocean steamships can ascend to the city; that is to say, all drawing less than 27 feet of water. During the past summer the docks were, therefore, crowded with ocean vessels. At Bruges, a canal of equal capacity has been opened, but the traffic, in this case, remains to be created. The terminus of the canal is outside medieval Bruges, which seems to have changed but little since Charles the Bold of Burgundy, who fell in battle with the Swiss, was borne to his last resting place in the Cathedral of Bruges. Already, however, new warehouses are going up alongside the docks, and before many years there will be a new Bruges where now there is nothing but open country.

One of the few commendable features of the Tariff Act passed last summer was Section 5, relating to trade with the Philippine Islands. The treaty of peace with Spain in 1899 provided that for 10 years Spain should have the same treatment in the Philippine markets as the United States. That period having expired, Congress took the first opportunity to provide that United States products should be admitted to the Philippine markets free of duty. In return it was provided that all Philippine products should be admitted to United States markets, free of duty, except:

(1) rice (a concession to the Texas rice growers);
(2) sugar in excess of 300,000 gross tons;
(3) wrapper tobacco in excess of 300,000 pounds;
(4) filler tobacco in excess of 1,000,000 pounds;
(5) cigars in excess of 150,000,000.

The free admission is, however, conditioned upon direct shipments of commodities from the country of origin to the country of destination. This provision is intended to eliminate the entrepot trade at Shanghai and Hongkong. It may be added that the restrictions as to rice, sugar and tobacco are theoretically indefensible, especially in view of the fact that no similar restrictions were placed upon the import of goods from the United States into the Philippines; but that they are not at present of serious importance. The rice produced in the Philippines is far from sufficient to supply the home demands, and the total production, both of sugar and tobacco in the Islands, in excess of the amounts permitted to be imported into the United States, is used at home. In fact, the total exports of these commodities have never reached anything like that amount. Already there has been a marked advance in sugar and tobacco in the Philippine markets

amounting to 25 per cent. in the case of sugar and 40 to 50 per cent. in the better grades of tobacco. Commercial prosperity is thus in sight for the Philippines for the first time in their history. Under the new conditions the United States will no doubt become the chief market for the Philippine products, as it is for the products of Porto Rico; and in return will supply the great bulk of the Philippine imports. During the month of September, 1909, the shipments from the United States to the Philippine Islands were more than twice as great as during any previous September.

The Alaskan Central Railway from Resurrection Bay towards the Tanana has been reorganized as the Alaska Northern Railway and it is claimed that sufficient financial backing has been secured to put it through. The distance to Fairbanks is about 450 miles. For the present it is intended to reach merely the Matanuska coal fields.

By order of President Taft, La Boca, the Pacific terminus of the Panama Canal, has been re-named Balboa, in honor of the first white man to look upon the Pacific Ocean.

THE WORLD'S RICE CROP.—The world's rice crop is estimated, in very round terms, at 175 billion pounds per annum, of which 60 billions are produced in British India, 50 to 60 billions in China, 15 billions in Japan, 6¾ billions in Siam, 6½ billions in Java, 5 billions in French Indo China, 3 billions in Korea, 2¾ billions in Formosa, three-quarters of a billion pounds in Italy, and a half billion pounds each in Spain, Ceylon, the Philippine Islands and the United States. Rice forms the chief cereal food of about one-half the world's population, and wheat the chief cereal food of the other half. Curiously, too, the quantity produced of these two cereals apparently differs but little, the latest estimates placing the world's rice crop at about 175 billion pounds and the world's wheat crop at 3,181,000,000 bushels, which equal about 190 billion pounds.

Of the 608 million pounds of rice produced in the United States in 1908, 52.8 per cent was produced in Louisiana, 41.8 per cent in Texas, 2.2 per cent in South Carolina, 2.1 per cent in Arkansas, and the remainder in Georgia, Alabama, Florida, Mississippi, and North Carolina.

COFFEE IN BRAZIL.—There are nearly 654,000,000 coffee trees in the State of São Paulo, Brazil, the estimated yield of which in 1909-10 is 11,238,029 bags of coffee. This amount, plus 861,250 bags which it is calculated will be exported through Santos from the south of Minas and Paraná, represents practically the export quota of the Republic.

—From *Bulletin of American Republics,* October, 1909.